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Journal of the Society of Arts.

FRIDAY, SEPTEMBER 12, 1862.

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INTERNATIONAL EXHIBITION of 1862.

REPORTS OF THE JURIES.

The Council of the Society of Arts have felt the importance of having some permanent and authoritative Record of the International Exhibition, and finding that Her Majesty's Commissioners have provided only for the publication of the awards of the Juries, but not of their Reports descriptive of the Progress of Industry since the Exhibition of 1851, the Council have undertaken this work, with the co-operation of Her Majesty's Commissioners and of the Juries, and have placed the matter in charge of Dr. Lyon Playfair, the Special Commissioner of the Juries.

The Reports will be published in super royal octavo, to range with the one-volume Jury Reports of 1851. The price of the volume, bound in cloth, to Members of the Society of Arts, to Jurors, and Guarantors, is fixed at 10s. ; to other persons, 15s. If bound in morocco, 7s. 6d. additional in each case.

Forms of application for copies have been issued to Members of the Society, to Jurors, and to Guarantors.

It was the intention of the Council to issue the volume complete in the early part of the present month, but as several of the Reports have not yet been received by Her Majesty's Commissioners, the completion of the entire work has been unexpectedly delayed; the Council, however, unwilling to defer the publication of the Reports already completed, have determined to issue to the subscribers those that have been received up to the present time. When all the Reports are delivered, the parts now about to be issued to subscribers will be exchanged, if uninjured, for the perfect volume, bound or unbound, as desired.

AWARDS OF MERIT.

The following circular has been issued; a copy will be furnished to any exhibitor on application to the Secretary of the Society of Arts.

**Society for the Encouragement of Arts, Manufactures,
and Commerce,
John-st., Adelphi, London, W.C., Aug. 1862.**

Sir,—The Council of the Society of Arts have decided to invite the opinion of the Jurors, the Commissioners for the Colonies and for Foreign Countries, and the principal Exhibitors at the International Exhibition, on the question of Awards of Merit in connection with International Exhibitions; and I am directed by the Council of the Society of Arts to transmit to you the accompanying Queries, with a request that you will favour them with your views on the subject, it being the intention of the Council to embody the answers they may receive in a public Report:—

1.—Are you of opinion that Awards for Merit, by Medals or otherwise, in International Exhibitions, are desirable?

2.—State the reasons for your opinion.

3.—Ought Works of Fine Art and Designs to be excluded from the Awards?

4.—Can you suggest any better method than the appointment of Jurors for making the Awards?

5.—Can you suggest any improvement in the Constitution or proceedings of the Juries?

6.—Is any Appeal from the decision of Juries desirable?

7.—If you think Awards undesirable, can you suggest any other means by which meritorious productions may be brought to the notice of the public?

8.—Have you any further suggestions to offer on the subject?

It is particularly requested that any replies with which you may favour the Council may be sent not later than the 15th of September, and that they may be written on foolscap paper, on one side only, with an inch margin, and numbered corresponding to the number of the questions.

I am, Sir, your obedient servant,
P. LE NEVE FOSTER, *Secretary.*

NOTICES TO INSTITUTIONS.

Those Secretaries of Institutions who have not already forwarded to the Secretary of the Society of Arts copies of their last Annual Reports, are particularly requested to do so.

The Programme of Examinations for 1863 is now ready, and two copies have been sent to each Institution in Union and Local Board. Additional copies may be had gratis on application to the Secretary.

The Papers set at the last Examination are now published in the form of a pamphlet, which may be had of Messrs. Bell and Daldy, Fleet-street. Price Sixpence.

CONVERSAZIONE.

The third Conversazione of the present season will take place at the South Kensington Museum on the 8th October.

INTERNATIONAL EXHIBITION OF 1862.—VISITS OF SCHOOLS.

The following is a continuation of the Schools reported to Her Majesty's Commissioners as having entered the Building, from 1st to 6th September, 1862 :—

DATE.	FROM WHAT LOCALITY.	NAME OF SCHOOL.	BY WHOM SENT.	No. of Children from each School.	Total each day.
Sept. 1	Hatfield	National	Rev. W. C. Talbot	16	
„ „	Croydon	Archbishop Tenison's	Rev. J. White	18	34
„ 2	Doctors'-commons	Joyes	Subscription	19	
„ „	Charlotte-street, W.	Percy Chapel	Rev. J. B. Heard	32	
„ „	Putney	National and Night	Parishioners	285	
„ „	Brick Hill-lane, City.	Queenhithe Ward	A. MacDougal, Esq.	42	
„ „	Leyton, Essex	Sulway House	Dr. Aldom	25	
„ „	St. Margaret's, Westminster	National	Rev. M. Davies	22	
„ „	Westminster	Wesleyan	J. R. Kay, Esq.	20	445
„ 3	Kensal-green	National	Alfred Haines, Esq.	47	
„ „	Stoke Newington	Lancasterian	Committee	41	
„ „	Cranford Hall, (Hounslow)	Commercial	Mr. G. Verney	52	
„ „	Lime-street, City	Langbourn Ward	Committee	60	
„ „	Berkshire	Cookham Dean	Rev. G. H. Wilson	30	
„ „	Highgate	National	Wm. Ford, Esq.	10	
„ „	Croydon	British	Subscription	30	
„ „	West Ham	Sunday	F. Fenn, Esq.	12	
„ „	Wellesbourne, Warwick	National	Rev. J. Knipe	14	296
„ 4	Highgate	National	W. Ford, Esq.	13	
„ „	Westminster	Wesleyan	J. R. Kay, Esq.	32	
„ „	Mortlake	National	Mrs. Bates	72	
„ „	Mark House-lane	Do.	Mr. Milne	24	
„ „	Southwark	Jews' Evening	Baroness de Rothschild	26	
„ „	Richmond	Christ's Chapel	Subscription	20	
„ „	West Drayton	National	Rev. R. De Burgh	41	
„ „	St. Paul's, Covent-garden	Parochial	Chas. Few, Esq.	18	
„ „	Westminster	Jews' Free	Samuel Isaacs, Esq.	67	
„ „	Greek-street, Soho	Do.	Do.	67	
„ „	Spitalfields	Jews (Male)	Baroness Rothschild	70	
„ „	Croydon	British	Subscription	16	
„ „	St. Mary Abbotts, Kensington	National and Industrial	Do.	357	
„ „	Kingston-on-Thames.	National	Rev. H. P. Measor	34	
„ „	Westminster	Wesleyan	J. R. Kay, Esq.	18	
„ „	Snaresbrook	Merchant Seamen's Orphan Asylum.	Joseph Adams, Esq., of Limehouse	120	995

VISITS OF WORKMEN.

The following is a continuation of the return of the number of workmen, mechanics, operatives, and others who have visited the building from 1st to 6th September, 1862 :—

DATE.	DESCRIPTION OF PERSONS.	FROM WHAT LOCALITY.	BY WHOM SENT.	NUMBER.
Sept. 1	Builders	Camberwell-green	Joseph Thompson, Esq.	45
„ 2	Seamen	H.M.S. Formidable, Sheerness	Vice-Adm. W. J. Hope Johnson	144
„ „	Inmates of Workhouse	St. George's, Hanover-sq.	Committee	72
„ „	Enniskillen Dragoons	Maidstone, Kent	Captain Weatherby and Cornet Froom	45
„ „	Electro-plate Workers	Woburn-green, Bucks	F. Higgins, Esq.	157
„ 3	Glass Makers	Birmingham	Chance, Brothers, and Co.	680
„ „	Brewers	Bath	Pinchin and Co.	70
„ „	Sub-marine Cable Makers	Greenwich	Glass, Elliott, and Co.	90
„ 4	Seamen	H.M.S. Wizard, Woolwich.	W. Denefield, Esq.	13
„ „	Farmers' Labourers	Beaulieu, Hants	Duke of Buccleugh	78
„ 5	Brewers	Hornchurch, Essex	Thomas Woodfine, Esq.	45
„ 6	Builders' Operatives	Union-street, Borough	Mr. Thomas Rider	105
„ „	Members of Choir	Evans' Hotel, Covent-garden	Mr. Green	27
			Total	1,571

MINERAL PRODUCTS OF INDIA.

The following information on this subject is extracted from the Descriptive Catalogue of the contributions from India to the International Exhibition:—

Iron ores are produced in the state of Ulwar. The fuel employed in smelting them is charcoal obtained from the jungle covering the hills near which the ore is found. That obtained from the Dhak tree (*Buteafrondosa*) is the best, and costs about 1 rupee for 6 maunds. To smelt 16 maunds of ore, 24 maunds of charcoal are required, and this will yield 4 maunds of iron, valued at 3 rupees per maund. The details are as follows:—16 maunds of ore, including carriage, Rs. 1-8; 24 maunds of charcoal, Rs. 4; labour, Rs. 4-12; contingencies, Rs. 0-8—total, 11-8.

An abundance of ironstone is found in the district of Sumbulpore, and it is plentiful in the Cuttack tributary states of Talchere, Dhenkanal, Pal-Lahara, and Ungool, and indeed throughout the hilly country bordering the settled districts of this province on the north-west. In Sumbulpore, according to Dr. Shortt, of the Madras army, who passed through that district in 1855, the crude iron is sold at 1 anna per seer, which is equivalent to about three-fourths of a penny per English lb. From a report by the same observer, the following information relative to the method of smelting is gathered. No flux is used; the broken ironstone is mixed with charcoal, which can be prepared in any required quantity on the spot, and the mixture is then, probably in alternate layers, put into the furnace,—a kiln in miniature, standing about four feet high, and made of clay. The top is open, and the bottom and sides thoroughly closed. The fire is maintained by an artificial blast, introduced through a fire-clay pipe, which is sealed up with clay after the insertion of the nozzle of the bellows. The slag escapes, or more properly is raked out, through an aperture made in the ground, and which runs up into the centre of the furnace base. Three men—one to serve the fire, and two to work the bellows, are required to tend each furnace. Nearer home, this ore abounds, as has been observed, in Ungool, Talchere, Pal-Lahara, and Dhenkanal. The specimens sent are from Talchere and Dhenkanal. These are a red-ochry ore, said to produce very excellent metal, without the aid of a flux. The method of smelting here is very similar to that already described, the main difference being that the slag is passed out through an arched opening in the base of the furnace. The charcoal used is made from the *Sal* or *Shorea Robusta*. Limestone in calcareous nodules is abundant on the spot, in Ungool at least, but is nowhere used in smelting. The price of the crude iron in Ungool is a trifle less than 1 anna per seer. It is, as might be expected, mixed with impurities. A specimen of the Ungool ore, taken from the ground where it had lain exposed to sun and rain, gave 66 per cent. of teroxide of iron, equal to 46 per cent. of metallic iron. A sample from Pal-Lahara gave 60½ per cent. of the protoxide of iron, equivalent to 47 per cent of metal. The results are given on the authority of Mr. Piddington, late curator of Economic Geology, Calcutta. The native method of smelting is, however, rude and wasteful.

The part of the Vhyudhya Hills forming the southern portions of Shahabad and of Mirzapore, north and north-west of the Soane River, together with Mirzapore, south of the Soane, Rewah, Palamow, and, in fact, the whole chain and spurs of the Vhyudhya range in this neighbourhood, is full of mineral wealth of various kinds, and will doubtless, in the course of a few years, when railways run down the valley of the Soane, connecting the Gangetic valley with that of the Nerbuddah, be found to yield products of immense value. Abundant quarries of the *per* and *prot* oxides of iron, as also of the sulphate of iron, abound in the most accessible portions of the Kymore range. The Kymore range is the north-easterly spur of the Vhyudhya range, and fills all Southern Mirzapore and Shahabad. Most of the ores are peculiarly rich in metal, some of them even yielding 70 and 75 per cent. of pig iron, but without accessible coal they are comparatively useless. Considerable quantities of iron, and that some of the best in India, are annually produced in Palamow, Rewah, Bidjugghur, and Singrowlie. The iron from the latter place in particular bears a high character in the market, being tough, flexible and easily worked, while English iron having originally been smelted from an inferior ore (the clay ironstone) and with mineral coal, is almost unworkable by native blacksmiths. The greater portion of the ores, which are spread very largely over the table-lands of the Kymore plateau and in the face of its precipices, are found on what is generally supposed to be the old red sandstone superlying mountain, now fossiliferous limestone; but the best authorities have not decided yet the age of those rocks, the generally assumed theory being that they belong to the "old red sandstone." The whole of the Kymore range thus appears to consist of old red sandstone rock, superlying mountain limestone of indefinite thickness, while the jasper rock and trap rock, cropping out occasionally in the Soane, near the base of the main spur, which is the Rohtas range (a minor spur of the Kymore range), would lead us to suppose that stratum was the underlying one of the mountain limestone. Again, at Chynepore and at Sonar, near Sasseram, and in other localities, igneous action appears to have taken place upon the sandstone, more or less, rendering it intensely hard and flinty, while interstices here and there are filled with sulphate of iron and a substance resembling iron slag, almost as hard and heavy as iron itself. A little further south, about seven miles from the southern base of the Sasseram spur, an offshoot of the Rohtas range is found in the granite rocks of Bunmonee, cropping up above the surface to heights varying from one to 60 or 70 feet. These rocks are full of fragments of felspar, hornblende, and quartz, in large and broken masses, and would appear to have been mixed with the great mass while in a soft and ductile state. The base of the whole is a coarse granite. Thus we have three different bases cropping out, which must either wholly or in part underlie the sandstone; 1st, the jasper and trap rock in the Soane; the semi-igneous rock at Cheynepore, and the wholly igneous one of Sonar; and, lastly, the conglomerate granite rocks of Bunmonee; while up to the present time, the mountain limestone, which is the visible base, leaves us in the dark as to its origin by a total absence of fossil remains.

Although there is abundance of mineral coal in South Mirzapore, in Palamow, Singrowlie, and Rewah, native smelters use only wood charcoal prepared by themselves, and as their furnaces and tools are small, they can all be constructed and arranged by one man in half a day; this fuel and ore are close at hand to the furnace, the latter being re-made further in the jungle to suit their main requirements, while the wretched hut in which they live may well be prepared in the half-day remaining. The process employed by the smelters is a very simple one indeed. The furnace is built of clay, something like a small hollow cone, larger in the middle, and tapering up to the chimney and down to the blow hole, with a table at the top formed of bamboos, covered with clay, and of about 2 to 2½ superficial feet in area. The internal area of the furnace is not more than 2 to 2½ cubic feet, and is not more than 2½ to 3 feet in height. There are two round calabashes with a skin covering, and a string connected with a flexible bamboo. The smelter treads upon the skin covering with a sort of dancing motion, raising his feet in a peculiar manner alternately, exposing and closing the centre hole in the skin cover of the calabash, and at the same time holding on by his hand to the two bamboos right and left of the furnace, steadying himself, and alternately raising and depressing the string connected with the flap of the calabash with the same motion, occasionally feeding ore and charcoal from the table, with a small wooden scraper, which he holds at the same time in his right hand. Two hollow bamboos cased with clay, each connected with its own calabash, and meeting at the nozzles, which are brought into one focus in the luted fire-hole, constitute a primitive and powerful bellows, causing a constant and strong stream of air for the blast, and thus keeping the half-melted metal and charcoal in a bright ignition. As the charge falls, more ore and fuel is pushed in from the table, the dancing motion and consequent blast being constant. To each furnace there are two men, and it is kept in full play all day. In each day, if the smelters have wives and children to break up the ore in ½ or ¼-inch cubes, and bring charcoal, they will charge the furnace four times, and the day's work will be four or five malleable pigs of 2 to 2½ seers each, or in all 12 annas to a rupee's worth of iron. They employ no flux, and the slag runs off first in pipe-like lumps. The furnace is emptied at each charge. The metal never runs liquid from the furnace, but falls to the bottom, below the blast tube, from whence it is taken in a flaming mass by a pair of iron tongs, and which incandescent mass is hammered on a hard stone, or, if the smelter be rather rich, on a rough anvil, into a double-wedge shaped pig, and so on *ad infinitum*, the labour being divided between the smelter and his family, who think themselves fortunate if they can earn 1½ anna per head. Some years ago, Mr. Bingham, hon. assist. magistrate of Chynepore, erected a small brick furnace and used three large blacksmith's bellows, using mineral coal and limestone flux, but although he smelted the iron, yet from want of acquaintance with the *modus operandi*, he ran off metal slag and flux in one homogeneous mass, so that the pigs were of no value. He saw, however, enough to convince him of the extreme richness of the ores. He had bar iron forged under the hammer, which was tested against English rolled bar iron, and found superior in tenacity and strength, but more flexible. Major John Laughton, of the Bengal Engineers proposed its use for lattice bridges on the Grand Trunk Road, but no further action was taken, nor can any great action be taken till railways or canals bring the coal to the ore, or the ore to the coal, and then the valleys of the Soane, Koyle, and Nerbudda will soon become the Crewe and Wolverhampton of India. The cost of the ore would be merely nominal, probably not more than two per cent. upon the cost of quarrying; and the ores being all above ground, would reduce the cost of quarrying to a minimum. One rupee per ton for royalty and cost of quarrying would give an ample margin for all contingencies, allowing rates of labour to remain as at present. Charcoal, as at present used by native smelters, may be obtained at 10 or 11 maunds per rupee, say 2½ to 3 rupees per ton, in the forest, to which, of course, must be added cost of carriage to site. Native charcoal is, however, made in open kilns in a most wasteful manner. Burnt in close kilns, more than double the quantity, and that of a much better quality, would be obtained, while the tar and wood vinegar obtained at the same time would materially diminish the cost.

Iron ore (Dhaoo) is produced in the land lying between Mouzah "Sathoo Nurwaree" of the Gwalior District and "Punehar," *i.e.*, about four cross (eight miles) from east to west, and one cross (two miles) north to south; also in the hills adjoining. In that neighbourhood people dig for the ore; after digging 20 cubits deep and 50 yards square, a description of earth called dhaoo (the ore), which is like small stones, but very soft, is found. This earth is loaded on bullocks, and taken to "Dhoa" and "Bugrowlee" and other places, where it is smelted and iron made from it.

The cost of digging and refining the ore is 12 annas per maund. A piece of iron about 20 seers in weight is made in three hours, at the cost of 12 annas. The price in the bazaar of 20 seers of iron is 14 annas, thus a profit of two annas is derived by the manufacturer.

The ore actually worked at Tendookhera, in the Nursingpore district, is a large vein or lode in the limestone schist formation of the Indian Geological Survey, and the only rock in its immediate vicinity is hard grey and blue crystalline limestone. It occurs to the north of the Nerbudda in the open flat country between the river and the Vhyudhya Hills. Only one mine is worked at present, but ore of a similar quality has been found at one or two other places in the neighbourhood. The only fuel used is charcoal, which is of very fair quality. Some coal mines also are situated at Mohpanee, not far from Tendookhera. The distance of fuel from the mines is from five to ten miles. The iron is smelted in small clay furnaces, blown by goat-skin bellows, worked by the hand. It is obtained in small lumps or blooms called "cutcha," or raw iron, and is afterwards re-heated and hammered, and then sold as "pucka," or finished iron. Intermixed with the raw iron as it comes from the furnace, is a sort of crude steel, which is carefully selected and used for the manufacture of tools and agricultural implements. The ore is largely smelted by the natives at the town of Tendookhera, about two miles from the mines, where, during the eight dry months of the year, about sixty furnaces are worked, but the mines having now been leased to the Nerbudda Coal and Iron Company formed in London, they will shortly commence work on a larger scale with European appliances. About 5 tons 3 cwt. of iron ore, and 5 tons 12 cwt. of charcoal, are used for the manufacture of one ton of "pucka," or finished iron. The ore contains upon an average about 40 per cent. of iron; it is of a calcareous nature, very fusible, and somewhat resembles the ores of the forest of Dean. The ore is obtained by means of pits sunk from 30 to 40 feet, through the alluvium of the valley, to the ore. They are washed in during the rains, and require to be re-sunk yearly. The iron is obtained at a very small cost, as the Government do not demand at present any royalty from the smelters. The fuel or charcoal is sold at from 3 to 3½ buffalo-loads per rupee, which is equivalent to about 8s. per ton. The pucka iron sells at from 5 to 6 rupees, 12 shillings, per goan or bullock-load of three maunds, equal to 24 bundles, or from £4 10s. to £5 8s. per ton. The iron is sent by bullock carts and buffalos to all fairs of any consequence within 100 miles, and in some instances is sent even 200 and 250 miles. From the iron of these mines, several years ago, a very good suspension bridge was built near Saugor.

The Agureea mines, in Jubbulpore, are situated on a hill consisting of iron ore found at 1½ feet from the surface, and extending over an area of about 60,000 yards square and 30 feet deep. The ore exists in thin flakes of a grey iron colour and metallic lustre. The nature of fuel used is common wood charcoal, and for refining the metal, bamboo charcoal; the fuel is brought from a distance of about five miles from the mines. The ore and charcoal are thrown in small quantities every half hour into an earthen furnace 5 feet high and 2 feet square; a part of the bottom of the furnace is filled with fuel only; this being kindled, a pair of bellows is applied to raise the heat, and a passage made at the side of the furnace for the melted metal to run out. Four maunds (320 lbs.) of ore and 2½ maunds of charcoal are daily used in a furnace; the fuel is used in the proportion of five-eighths or 62 per cent. of the ore for smelting, and one-fifth more for refining the metal. A furnace furnishes daily two maunds (160 lbs.) or 50 per cent. of the crude iron from four maunds of the ore; this, when forged, yields 30 seers, or nearly 19 per cent. of wrought iron. The ore is simply dug out with pickaxes; it costs 6 pie per maund for excavating and carrying to the furnace. The fuel or charcoal costs Rs. 1-1-6 per maund of wrought iron. The entire cost of the pure metal obtained amounts to Rs. 1-13 per maund, including labour and materials. The ore is generally sold at the works and conveyed on bullocks to different markets. When brought to Jubbulpore, the nearest market, it costs 2 annas 8 pie per maund, exclusive of duty. Agureea is not far from the proposed branch line of the East Indian Railway to Allahabad.

Granulated iron is found lying on the surface of almost all the high grounds in Chota Nagpore; where it lies the soil is only surface, the rocks primary formation.

Iron is found in considerable quantity, and of a very fine description (the magnetic), closely resembling the Swedish, in the Himalayas, about 30 miles north-east of Dhurmsala, in the Kangra district; close to the sanatorium of Dalhousie; in the native states of Maudi and Kotkai; in the Sulymani range near Kolachi, on the western frontier of the Punjab. In all these places mines are worked, but iron is also to be found in the Salt range, in the Afidi hills to the west of the Peshawur, and the Mewatti hills of the Goorgaon district. But there is one great obstacle to the successful working of iron mines in all these localities, viz., the absence of coal. In the year 1858, sixty bars of Kangra iron were sent to England, in order to ascertain the quality of the metal and its value in the European market. On being tested at the Atlas works of Messrs. Sharp, Stewart, and Co., of Manchester, while the best English iron yielded at a pressure of about 56,000 lbs. to the square inch, the Kangra iron, in the state in which it was received, required a force of 61,300 lbs. per square inch to break it; and, after being hammered in Manchester, sustained a pressure of 71,800 lbs. The quality was considered " equal to that of Yorkshire iron." At present, however, its cost in Kangra, about 30 miles from the mines, is no less than £14 a ton.

Lead is found in Ragoon, and was exported, in the year 1860-61, to the value of £12,000.

A plumbago mine was discovered by Dr. W. J. Thornton, Civil Assistant-Surgeon, Goorgaon, in October, 1861. The mineral is found in masses of variable sizes, and in general quite detached; though, in some cases, the rock all round is full of plumbago mixed with finely divided micaceous particles. Provision has been made in the Budget of 1862-63 to admit of further inquiries and examination of the deposits being carried on.

Sulphuret of antimony is said to be found in the Salt range near the Keura salt mine. Vast quantities of antimony have been found by Major Hay in the Himalayan ranges of Spite. Trisulphuret of antimony is imported from Cabul, and is said to be found in small quantities in the Salt range.

Gold is found in the beds of rivers in Purnalia, Chota Nagpore, and in the sands of the Dirjmoh River, Luckimpore. It is found in minute scales in the sandstone of the Salt range, a lower range of hills running parallel to the Himalayan chain, between the rivers Indus and Jhelum; it is also found in small quantities in the sands of the Indus, Jhelum, Beas, and Sutlej; but the operation of gold-washing is not very remunerative, amounting on an average to not more than from 3d. to 6d. a day, and the proceeds of the annual lease of gold-washing amounted last year to but £84. Gold dust is also imported from Elaché, in Khoktan.

Gold dust is extracted from sand in the beds of rivers in Maunbhoom and Palamow, and other places, but not in large quantities.

Copper is found at Ulwar; also at Debrooghur and Seebsaugor, where the fuel used for smelting is charcoal made from the extensive forests in the immediate vicinity of the mines and works in Landoo, in Dalbhoom, and Singbhoom, in the south-west frontier of Bengal. The distance of the works from Calcutta is about 140 miles, and they may be reached *viâ* Midnapore or *viâ* Raneegunge and Purulia.

Messrs. Phillips and Darlington's analysis of specimens gives:—Oxide of copper, carbonic acid, water, oxide of iron and alumina, lime, sulphur, silicious gangue, silver, and arsenic. By assay the sample gave good copper 31½ per cent. and silver 2 oz. 5 dwts. 17 grs. per ton of ore.

The quality of the copper is thus reported on by Colonel Baird Smith, C.B., Mint Master of Calcutta, No. 481 of 1859:—Report on copper, the produce of ore raised from the copper mines of Singbhoom in the south-west frontier. Three slabs weighing about 139 lbs. These were submitted to a lamination, and proved to be well suited in all respects for purposes of coinage. The quality of this metal is excellent, being scarcely inferior to the best, equal to the average, and decidedly superior to several shipments of imported copper.

Coal is found in Ungool, and may exist in different localities throughout the immense extent of wild and jungly country comprised in what are called the " Garjats," or Hill States, forming part of this province. Within the limits of the Sumbulpore district, extensive veins are said to exist. A careful, though unprofessional observer, writing in 1855, states that about sixty miles north-west of Sumbulpore, there is such a bed of coal, while, in other localities visited by him, the country around for miles indicated the existence of coal deposits extending up the " Ebe," a tributary of the Mahanuddy. Strata of from 1 to 22 feet were to be seen forming the banks of a nullah, while drifting down the river were masses of coal, which ignited readily and burnt well. With regard to the coal, so called, found nearer Cuttack, and mainly in the tributary state of Talcheer, we have fuller particulars, for not only has the vein or field been frequently visited by Europeans, but samples have been analytically examined. The value of this mineral, if found here in sufficient quantity and of proper quality, would, of course, be infinitely greater than that found in Sumbulpore, because of the comparative facilities afforded for transport to the sea, by river carriage. The best coal, such as it is, in " Talcheer," is to be found at and in the vicinity of " *Gopaulpershad*," a village in the above-mentioned estate. For four or five miles above this place, the alleged coal deposit crops out along the bank of a nullah, here and there forming abrupt cliffs 20 to 25 feet high. Blocks of coal are also found scattered about in the circumjacent forest. This bed is said to be of considerable extent, running far into the Government estate of Ungool. There is also another field reported to exist in the estate itself. Two specimens of " Talcheer" coal, one of them from " Gopaulpershad," were submitted for examination to the curator of Economic Geology at Calcutta, in 1855, and, allowing for the rejection of what was wholly shale, the results were for *picked* " Gopaulpershad" coal:—

Specific gravity	1·42
Gaseous matter	36·90
Water	3·25
Carbon	51·75
Ash (fawn-coloured)	8·10

For the second specimen, which was not absolutely shale, the results were as follow:—

Gaseous matter	17·75
Water	14·37
Carbon	35·63
Ash	32·25

It is only fair, however, to state, that the results of these analyses, while they are the most recent, are the most favourable, at least the first, which have been obtained for Cuttack coal; and, moreover, that specimens taken from the same locality had been previously submitted to professional examination, and tested both in the crucible and the steam engine, with very unfavourable results; and it must be further added, that the results of a geological survey of the so-called " Talcheer" coal fields, made in the season of 1855-56, are decidedly against the discovery of any workable coal, in " Talcheer" at least, the geological conformation coexisting commonly with coal deposits being found to be wanting.

The coal mines in Nursingpore are entirely confined to the south side of the Nerbudda Valley, where they form a strip or band of irregular width, along the foot of the Puchmurree hills. Thin seams of inferior coal, from 18 inches to 3 feet thick, have been found also on the Shere River, but the only workable seams are at Mohpanee, on the Seeta-Rewah river. At this point three seams, respectively 10 feet, 6 feet, and 3 feet 6 inches thick, are found. The coal is of very fair quality, resembling that of Bengal, and small quantities that have been used experimentally by the Great Indian Peninsular Railway Company and the Indian navy, have been very favourably reported of. The mines have been leased to the Nerbudda Coal and Iron Company, and will shortly be worked.

Kurhurbalee, in the district of Hazareebaugh, contains several valuable seams of coal varying from 7 to 16 feet in thickness, which are worked by the East Indian Railway Company. In 1860-61, 275,256 maunds of coal were raised. This coal is superior to any of the coals raised elsewhere in Bengal. A comparative trial in the locomotives of the East Indian Railway, continued for three months, showed a superiority, amounting to 13 per cent., over the good steam coal of the Raniganj field. Kasta is situated to the north of the Adjai River, in the extreme north of the great Raniganj field. Here an immense seam of upwards of 30 feet in thickness crops to-day, and is worked in open quarries. The lower 11½ feet of this are of superior quality. 11,892 maunds were raised in 1860-61. It is less accessible than other collieries. At Chokidanga, the most northerly of these, a fine seam of 15½ feet is worked. The average outturn of three years has been 360,000 maunds. At Toposi, a seam (higher in the series of rocks) of 22 feet is worked. In 1860-61, 300,000 maunds were raised. Bansra is another seam still higher in the series, of about 7 feet in thickness. In 1860-61, 70,000 maunds were raised. At Mangalpur, a long established colliery, a seam of 15½ feet, including 9 inches of shale, is worked, yielding 1,000,000 maunds, in 1860-61. The Chokidanga, Toposi, Bansra, Mangalpur, Babùsol, and Harispur collieries are all on the Singàrun, a feeder of the Damùda River, and in the Eastern portion of the great Raniganj coal field. Babùsol and Madhubpur (or Harispur) are situated in the lower portion of the Singàrun stream, and are the most eastern collieries in the field. From Babùsol 84,000 maunds, and from Harispur 440,000 maunds, were raised, in 1860-61. Rogonathchuk is on the banks of the Damùda river, and is one of the oldest collieries in the field. The bed is 12½ feet thick, and yielded, in 1860-61, 300,000 maunds of coal. The most extensive workings at Raniganj are near the Damùda river. The entire seam is 13 feet in thickness, divided by a band of shale into two seams of 9 ft. and 3ft. The Raniganj workings yielded 1,600,000 maunds in 1860-61. Bhangaband is in the same neighbourhood, and yielded, in 1860-61, 250,000 maunds. Banali is a recently opened colliery, where a fine seam of 12 feet is worked at a depth of 43 feet below the surface. Futtehpur is on the Grand Trunk road. The bed is of 10 feet in thickness, and of excellent quality. In 1860-61, 150,000 maunds were raised. The Rogonathchuk, Raniganj, Bhangaband, Banali, and Futtehpur collieries are in the middle of the Raniganj field. The Hattinal colliery is in the west of the Raniganj field, near the junction of the Baràbar and Damùda. The seam is 8½ feet thick, the pits only 42 feet, the outturn in 1860-61, 200,000 maunds. Chinakùri (Cheenakooree) is close to Hattinal, and coal has long been worked there. In 1860-61, its outturn was 3,290,000 maunds. Dùmarkùnda lies to the west of the Baràkar, and is the most westerly colliery now worked in the field. These three collieries, Chinakùri, Hattinal, and Dùmarkùnda are all in the western portion of the Raniganj coal field. At Panchbyni a 7 feet seam has been worked to some extent in open quarries. At Chilgo a 5 feet seam yielded 20,000 maunds in 1860-61. At Oormoo, two seams of 7 feet and 3 feet produced 30,000 maunds in 1860-61, and at Bankijora, a thick bed of 19 feet, worked in open quarries, produced 30,000 maunds. The Chilgo, Oormoo, and Bankijora collieries are often spoken of as the Alubera collieries. At Bhorah, a thick seam of 17 feet produced, in 1860-61, 700,000 maunds. This colliery is only 20 miles from the Ganges. It is worked in open quarries. These collieries are all in the Rajmahal hills. That of Panchbyni is on the Brahmini stream, at the extreme south of the hills. The Alubera collieries are near the Bansloi stream in the centre of the hills; and the Bhorah colliery to the north end.

The following is the general classification of all these coals, with the names of the proprietors, and arranged in the order of the relative amounts of fixed carbon which they contain, which may be taken as a fair index of their relative value as fuel.

NAMES OF COLLIERIES.	Thickness of seam in feet.	COMPOSITION OF COAL.			PROPRIETORS.
		Carbon.	Volatile matter.	Ash.	
Kurhurbalee...	7 to 16	66·70	24·80	8·45	East Indian Railway Company.
Futtehpur	10	63·80	25·00	11·20	Messrs. Apcar and Co.
Dumarkunda ..	10	62·40	22·60	15·00	Bengal Coal Company.
Kasta	30	61·40	28·00	10·60	East Indian Coal Company, and Messrs. Nicol & Sage.
Chokidanga ...	15½	56·80	34·00	9·20	Messrs. Nicol and Sage.
Chinakuri	10½	53·20	35·50	11·30	Bengal Coal Company.
Hattinal	11	52·60	33·00	14·40	Beerbhoom Coal Company.
Madubpur ...... (Harispur)	17	51·10	35·40	13·50	Bengal Coal Company.
Raniganj	9	50·80	36·00	13·20	Do. do.
Do.	3	50·30	36·30	13·40	Do. do.
Toposi...	22	49·20	35·40	15·40	East Indian Coal Company.
Bansra	13	47·00	40·00	13·00	Do. do.
Rogonathchuk.	10½	46·90	35·00	18·10	Beerbhoom Coal Company.
Babusol	17	46·00	35·40	18·60	Bengal Coal Company.
Chilgo	5	45·50	43·50	11·00	Messrs. Eaton & Browning.
Oormoo	7 & 3	45·00	44·60	10·40	Do. do.
Panchbyni	7	44·20	34·10	21·70	Messrs. Mackey and Co.
Mangalpur......	15½	43·90	38·40	17·70	Beerbhoom Coal Company.
Bankijora	19	43·50	42·00	14·50	Messrs. Eaton & Browning.
Banali............	12	42·60	44·20	13·20	Beerbhoom Coal Company.
Bhangaband ...	7	40·30	28·40	31·30	Bengal Coal Company.
Bhorah	17	25·20	7·20	37·60	East Indian Railway Company.

If, on the other hand, these coals were arranged according to the relative amounts of ash in each, which for many purposes is a more useful classification, they would stand as follows:—

	Amount of Ash.		Amount of Ash.
Kurhurbalee	8·45	Madubpur (Harispur)	13·50
Chokidanga	9·20	Hatinal	14·40
Oormoo	10·45	Bankijora...	14·50
Kasta	10·60	Dùmarkùnda	15·00
Chilgo	11·00	Toposi	15·40
Futtehpur	11·20	Mangalpur	17·70
Chinakùri	11·30	Rogonathchuk... ...	18·10
Bansra	13·00	Babùsol	18·60
Banali	13·20	Panchbyni	21.70
Raniganj (average of two seams)	13·30	Bhangaband	31·30
		Bhorah	37·60

The coals in the lower portion of the Damùda coal field are very frequently found intersected with basaltic trap, and in most cases the structure of the coal is entirely changed. The coal has become beautifully prismatic or columnar, and this may be seen over large areas.

Chalk is abundantly dug in the limestone range in the valley of the Soane, and it varies in colour from yellow, when it is starred with oxide of iron, to pure white; also from the dense hard substance of bluish white stone, which has to be crushed and re-made by water, to the pure white chalks. Quantities of this mineral are exported to the river markets on the Ganges. The best quality is worth about £1 10s. to £2 per ton on the banks of the Soane.

The sandstones of the Shahabad range have a high commercial value at Chunar and Mirzapore, being used as flagstones, and for ornamental purposes. The stones at those places owe their advantage to the proximity of the Ganges, which affords an easy river carriage; otherwise they are the worst and most destructible description of stone in the range. The millstones of Chynepore, Sasseram, Tilowlhoo (Ackbarpore perhaps may also be added), are famous, but must always be dear in a distant market for want of river carriage. The Soane causeway and the Koylwan railway bridge are built of the dense sandstone of Sasseram, while even little quantities are found in the higher portions of the range towards Rohtas. The best stone, while easily workable, is almost as hard as granite, and may be had of any colour, viz., white, crystalline, blue, grey, and all shades to a dark red.

There is close to Jubbulpore a range of low hills within a circumference of about ten miles, interspersed with masses of limestone both above and below the surface.

The fuel generally used and most available for burning the lime is brushwood. It is cut and brought from a distance of seven or eight miles. The stone is broken into fragments of 6 to 12 inches in size, then piled like a dome over a hole of about nine feet diameter dug in the ground, and a passage left for introducing the fuel. The kiln is kept burning continually for the whole of the day, and the lime removed on the following morning. The fuel is used in the proportion of 40 maunds to every 75 maunds of limestone. Seventy-five maunds of the stone yield about 50 maunds of well-burnt lime. The stone is simply collected and broken up by manual labour, and the cost of collecting and putting it in the kiln amounts to three rupees for every 100 maunds of lime. The fuel costs from five to eight rupees for every hundred maunds of lime. The entire cost of preparing the lime varies from 8 to 10 rupees per 100 maunds. The lime is at present only used in the city and station of Jubbulpore, and the locality is leased by government to a farmer from year to year for a trifling sum; but the railway works shortly to commence will enhance its value. The hills are conveniently situated both as regards the line of railway to Bombay and that to Mirzapore.

The so called mountain limestone underlies the whole of the Kymore range in Shahabad, and it also shows itself along the valley of the Soane, as far at least as Mungeysur peak in Mirzapore. In some parts, as in Rohtas, it crops up boldly to 200 or 300 feet, forming a sloping base to the precipitous sandstone rock. In these places, it appears there are three well-defined strata, viz., an upper one of a yellowish-blue mixed with disintegrated sandstone, sulphate of iron, and chalk—all in thin plates. Below that a more bluish grey limestone with occasional calcspar crystals, but generally of the same nature as a German lithographic stone. Stone for lithographic purposes was made from it, and used in the office of the Surveyor-General. The first stone was used in the press of Shah Kubeeroddeen Ahmed, of Sasseram. It answered admirably for the purpose, but the stone must be freshly quarried or it chips, as after exposure to the air it grows intensely hard, and could then only be sawn into shape. Outside stone of limited sizes can only be obtained, owing to the ages of *débris* and decay which cover the main strata, but after quarrying some feet into the living rock, it was established that lithographic stones of any size could be obtained. Under the aforesaid strata lies a very dense bluish-grey limestone, mixed with veins of calcspar. It is not used by native lime-burners as being untractable. This would be an almost indestructible building or flooring stone from its great hardness, much harder than granite, and approaching to porphyry. It may be had in large blocks, and, if sawn into slabs, would be a very handsome building stone, bluish-grey with white streaks, and moreover it would probably make a superior kind of lime. Immense quantities of lime are made from the quarries of the western bank of the Soane, and exported down the Soane and the Ganges as far as Monghyr. Perhaps 300,000 to 400,000 tons are made annually, and the material is inexhaustible. The same limestone rock crops out on the northern face of the range at intervals, between the Soane river and Mirzapore; and again, especially in the singular and interesting limestone caverns of Goopteswar, in the valley of the Doorgowtee River, at Beetree Band, in Khawah Koh at Mussay, on the Sooreh River and near Mirzapore. With canals and tramways, these quarries could supply all Northern India with the finest lime in the world. The cost of the lime at these quarries varies from 6 to 16 rupees per 100 maunds, or say 5 to 14 shillings per ton. The present system of lime-burning is a very imperfect one, and indeed only suited to native wants, but with European supervision, although the material could not perhaps be produced cheaper, it could be produced with much more certainty and evenness in quality. The great fault of these limes in the market is their excessive adulteration with chalk, white clay (disintegrated limestone), and wood ashes, but the ores are pure and, when burnt according to European practice, leave nothing to be desired.

Marble is to be found at Bhera Ghât, on the Nerbudda, near Jubbulpore, on the line of the railway to Bombay. It is plentiful and easily accessible. It has been used in a limited degree at Jubbulpore, sometimes to make lime, and other times for metalling roads. It is made up into images by natives, but does not take a good polish. A block was sent to the Paris Exhibition, and pronounced to be equal to Italian marble for statuary purposes.

Grey slate is found at Nilgiri, and is used for the purpose of making the marks on the forehead, nose, arms, and breast, more particularly affected by Hindoo devotees, and also by high class natives in the Madras Presidency, and by Stirling called "Meerchaum."

The Moongnee stone, apparently a kind of chloride slate, is, according to locally received accounts, when freshly quarried, comparatively soft and easily workable, but by long weathering becomes highly indurated, black, and bright. It comes from the hill state of "Nilgiri," in Orissa, in the Cuttack district, where extensive quarries are said to exist. This stone is used principally for the manufacture of utensils. Idols are also made of it, and if the popular assertion that it is the true "Moongnee" be accepted, this stone is that on which the finest specimens of native sculpture extant in the province are executed. It is probable, however, that "Moongnee" is a general term confined, not to one species of stone, but applying to several.

"Kharee" stone, used, among other purposes, for the manufacture of pencils and balls for writing on the ground or floor, being so used in all rural schools, and by native accountants, is found in the same district.

The supply of petroleum in Burmah is unlimited, but the price is high, it being a close monopoly of the King of Burmah.

That found at Akyab, is used by the natives for burning, by Europeans for medical purposes, by both for varnish and to preserve wood; it is also put on the bottoms of boats, being an excellent preservative of wood from insects and worms. In the island of Ramree there are 13 wells, in Cheduba 22 wells. Each well produces about two maunds per season, the aggregate produce of all the wells being 70 maunds per annum. The produce might be increased some 10 or 20 maunds by digging more wells. No petroleum is exported from the province. It is thick and dark coloured.

FLAX AND ITS PRODUCTS.

The readers of the *Journal* will recollect that letters from time to time, under this heading, have appeared in its columns, written by Mr. Wm. Charley, one of the Jurors of the Exhibition of 1851. The information he then derived, combined with the experience acquired by long residence near Belfast, the linen capital of Ireland, enabled him, in the year following, to comply with the request of the Society to prepare a few papers on the subject for publication in the *Journal*. Various causes led to the series being somewhat delayed, and spread over several years, between 1853 and 1861. They were, however prepared with the intention of future arrangement in a regular form.

Mr. Charley has now collected these letters into a volume, enlarging and revising them in accordance with the advance of knowledge on the subject down to the present time, forming a complete "Hand-book" of the Flax Industry.

The want of a book that would give all the interesting particulars of the history, recent progress, and general management of flax, has been admitted. The object of the present little work is to supply that want.

Mr. Charley, in his preface says:—

"In several of the British colonies, as well as in many parts of Great Britain and Ireland, there is a great desire among the agricultural community for information regarding the flax crop, and I therefore enter very fully into the details of its cultivation.

"The papers published in the *Journal of the Society of Arts* form the ground-work of the present publication. They have been re-arranged, enlarged, and revised, so as to bring everything, as nearly as possible, down to the present time; and an Appendix is added, which contains much useful information, especially on the subject of foreign tariffs."

The work is published by Messrs. Bell and Daldy, 186, Fleet-street.

STATISTICS OF WRECKS.

The Board of Trade return of the wrecks and casualties which occurred on and near the coasts of the United Kingdom in 1861 has just been published. From this report it appears that the number of casualties is greater than that reported in any of the preceding nine years, and 261 in excess of the annual average of the last six years. The numbers (exclusive of collisions) were, in 1857, 866; in 1858, 869; in 1859, 1,067; in 1860, 1,081; and in 1861, 1,171; and the increase is ascribed to a great extent to the gales of January, February, and November, in which alone there were 465 casualties (exclusive of collisions). The number of collisions, again, though slightly in excess of 1860, is under the number of 1859, the three years 1859, 1860, and 1861 having the respective numbers 349, 298, and 323; and on the whole the increase in the number of collisions is not proportionately so great as the increase of other casualties. In the number of lives lost there is a large increase as compared with last year, caused by the gales of January, February, and November, which increased the number of casualties. In 1860 there were 536, while in 1861 there were 884, but this number is less than the numbers in 1854 and 1859. The comparatively small number of lives lost in 1860 and 1861 is owing chiefly to the absence of the loss of any large passenger ship on the coasts. From a table appended, showing the force of the wind, it appears that nearly one-half of these casualties happened with the wind at and under force 8, or "fresh gale," or under circumstances in which a ship, if seaworthy, and properly manned and sound, ought to be able to keep the sea. Appended to the report are various other tables comparing past years with the present, and classifying the casualties in various ways. The most important of these shows the geographical distribution of the wrecks. According to this the three most fatal districts are from the Fern Islands to Flamborough Head, from Flamborough Head to North Foreland, and Skerries and Lambay to Fair Head and the Mull of Cantire. In the former district, in 1861, there were 40 ships wrecked, with a tonnage of 5,129, and 244 men; and the loss was, totally wrecked, 31; partially, 9; and the number of lives lost, 147. In the second district the figures are—ships, 24; tonnage, 3,998; men, 189; total wrecks, 18; partial, 6; lives lost, 111. And in the third—ships, 28; tonnage, 5,832; men, 216; total wrecks, 22; partial, 6; lives lost, 144. This, in the first two districts, is greatly above the average of the last 12 years, which, for the one district, is 55 10-12, and the other 89; but this is probably accounted for by the increase of the number of casualties to ships of the collier class, through the prevalence of north and east to south-east winds. In the third district the average of the 12 years, 133 1-12, is but slightly exceeded. The number of lifeboats under the management of the National Lifeboat Institution has increased from 124 in 1856 to 179 in 1861, and as compared with 1860 the increase is six. The number of lifeboats under other management was 59 as compared with 63 in 1860. Out of the whole number, 106 are subsidized by the Board of Trade direct, without the intervention of the institution; and of those remaining 14 are maintained by the institution, and 54 by local bodies. During last year the Board of Trade and Admiralty have supplied the crews of some of the Coast-guard stations with Captain Ward's life-belts and life-lines, the use of which will diminish the risk they run in putting to sea. To the mortar and rocket apparatus and lifeboats, as means of saving life, great credit is given; and from a tabular statement of the lives saved by assistance from the coast during the last seven years, it appears that the numbers have increased from 1,098 in 1855 to 1,516 in 1861. The sum paid to the Lifeboat Institution in 1861 is £2,877 3s. 2d. The payments by the Board of Trade direct for rewards and gratuities and for services at wrecks amount to £1,292 1s. 6d. The expense of maintaining the mortar and rocket apparatus is £2,246 6s. 4d., being a total payment of £6,415 11s. for saving and endeavouring to save life during the year 1861.

ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS, MANCHESTER.

At the last ordinary monthly meeting of the executive committee of this Association, held on Tuesday, September 2nd, Mr. L. E. Fletcher, chief engineer, presented his monthly report, of which the following is an abstract:—

"During the past month the ordinary visits of inspection have been made, and 8 boilers tested by hydraulic pressure, the following defects being discovered in the boilers examined:—Fracture, 3 (2 dangerous); corrosion, 26, (6 dangerous); safety-valves out of order, 14; water gauges ditto, 10; pressure gauges ditto, 13; feed apparatus, ditto, 4; blow-off cocks ditto, 37 (1 dangerous); fusible plugs ditto, 6; furnaces out of shape, 3; blistered plates, 2. Total, 118 (9 dangerous). Boilers without glass water gauges, 4; without pressure gauges, 16; without blow-off cocks, 11; without back pressure valves, 31.

"The principal cases of dangerous injury which have arisen this month have been due to corrosion, the continued recurrence of which shows the importance of having all boilers examined, not 'externally' only, but also 'internally and thoroughly.'

"Another explosion has occurred during the last month to the class of plain cylindrical egg-ended boilers, fired externally. The boiler in question, which was under the inspection of this Association, was one of a series of six connected together, in the midst of which it had worked, being the fourth from one end, and the third from the other. Its length was 30 feet, its diameter 5 feet, the thickness of its plates $\frac{3}{8}$ths of an inch, and its working pressure 50lb. The rent, as is usual in these cases, occurred at one of the transverse seams over the fire, but the development of the line fracture was somewhat peculiar. In ordinary cases these boilers, on explosion, separate at one of the ring seams into two distinct halves, which fly in opposite directions; but, in the present instance, the first belt of plates was completely severed from the remainder of the boiler and flattened out, having rent through the line of rivets at each of its four edges, while the egg-end had become entirely disengaged from it, and, in addition, was torn into two parts. The remainder of the boiler, which was by far the greater portion, being about twenty-four feet long, had flown to a distance of about eighty to ninety yards, and the chimney, which was reduced to a heap of ruins, had either been swept down by it in its course, or blown down by the impact of the steam.

"There was no evidence of there having been either deficiency of water or excess of pressure; while each boiler in the series was fitted with two lever safety-valves of three inches diameter, a glass water gauge, and a back-pressure feed valve. The exploded boiler was about four years old, and had been repaired seven months since, at the part immediately over the furnace, by the introduction of two new plates.

"It will be observed that the above explosion is another instance of the liability of these externally-fired boilers to rend at the transverse seams over the fire. The combined duty thrown upon these seams is so great, that there is more uncertainty with these boilers than with those of the internally-fired double-furnace class in ordinary use in Lancashire. All the points in the latter can be so entirely mastered that they may be thoroughly relied on, and if well made, and in sound condition, can, with proper care in working, be guaranteed as safe for a period of twelve months from the time of examination. Not so, however, with the externally-fired boiler, in which the shell has to endure the entire disruptive strain combined with the direct impingement of the flame. In the internally-fired boiler these two duties are divided; the shell, which bears the tensile strain, being guarded from the intense action of the fire, which the furnace tubes are adapted to bear, from their small diameter and facility for strengthening, either by flanged seams, hoops, or otherwise; while the deposit, which to a great extent rolls off the furnace crowns, and falls harmlessly to the boiler in one case, deposits itself immediately over the fire in the other. Thus the seam of rivets in externally-fired boilers have to contend with the combined influence of tensile strain, the direct action of the fire, and too frequently with an accumulation of incrustation tending to overheating, and even where this does not form a positive coat, it may yet suffice so to thicken the water that the steam lifts it from the surface of the plate, when over-heating unavoidably ensues; added to which sudden drafts of cold air, on opening the furnace doors, cool the outer laps of the plate at the seams, which thus become subjected to the constant alternations of expansion and contraction.

"Under these circumstances it is not surprising that the seams of rivets in under-fired boilers should frequently be found suddenly to give way, for which the surest remedy will prove to be the substitution of internally-fired boilers in their place. Where, however, those externally-fired are still adopted, it is earnestly recommended, in the first place, that good materials and workmanship should be secured; in the second, that every means should be adopted for the prevention of incrustation; and, in the third, that the seams of rivets should be constantly and narrowly watched, so as to detect the first signs of weakness, which should be immediately repaired.

"Ready examination is facilitated by setting these boilers, as some of our members are doing, with a single direct flash flue, in which are a series of bridges, one behind the other, for keeping the flame in contact with the boiler; an entrance being made beneath the furnace bars, as well as a small archway through the back bridges, to allow of a communication throughout."

EXAMINATION PAPERS, 1862.

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in May last:—

(Concluded from page 646.)

FREEHAND DRAWING.

THREE HOURS ALLOWED.

Make an outline, from memory, of any drawing that you have made during the last twelve months, either of furniture, ornament, foliage, or the human form.

Make an outline, half the size of life, of some portion of the engraving which is hung up. The candidate is at liberty to select what part of the print he will draw, and should take the portion which is most in accordance with the line of art he has studied.

Make an outline of the portrait the size of life.

Candidates are not required to do all three subjects.

DIRECTIONS FOR THE LOCAL BOARDS.

Hang up an engraving of Sir E. Landseer's Bolton Abbey, or if this work cannot be obtained, some other good engraving should be placed before the candidates in free-hand drawing.

Place an oil portrait of a man's head, the size of life, where it can be distinctly seen by the candidates. If possible the portrait should be of some well-known person.

GEOMETRICAL DRAWING.

THREE HOURS ALLOWED.

The constructions must be accurate, and show clearly, by plain and dotted lines, with appropriate letters of reference, the principles on which they are based. The constructions may be put in ink, or left in pencil, at the discretion of the candidate, provided they are distinct.

No deviation from the conditions of the questions can be admitted; and since no candidate must answer more than two questions from any one section, he is advised not to attempt more than the time will admit of his completing, since little or no credit will be given for incompleted or inaccurate answers.

I.

1. Draw a line AO, 5·2 inches long, divide it into 13 equal segments in the points B, C, D, E......O. From the points C, F, I, M, as centres, with radii of ·8, ·7, ·5, ·4 inches, describe concentric circles; strengthen (or put in ink) the parts of these circles, so as to form the pattern called in ornamentation a *guillochis*.

2. Draw 16 parallel lines ·1 inch apart, and a sufficient number of lines, at right angles to them, at the same distance apart; strengthen, or put in ink, or tint lightly, the appropriate lines, or spaces, so as to form a *fret*, or *Etruscan border*, between the two outside continuous bands.

3. Draw a circle of 3·5 inches radius, divide it into 32 equal parts for the points of a *compass card*, complete the figure, drawing the sides of the *points* tangents to a central circle of ·5 inches radius.

II.

1. Construct a mean proportional and a third proportional to two lines of 1, and 1·75 inches.

2. Divide a line 3·5 inches long into two parts which shall be to each other as 1·75 : 3·25.

3. Construct a square of 1·75 inches side and a rectangle equal to it in area, having its sides as 1·75 : 3·25.

4. Construct an equilateral triangle equal in area to a square of 2·5 inches side.

III.

1. Construct a polygon from the following conditions:—

Side AB = 2·5 inches. Angle ABC = 90°
" BC = 2 " " BCD = 110°
" CD = 1·75 " " CDE = 130°
" DE = 1·84 "

Write down the length of the remaining side E A, and the two angles DEA, EAB.

2. Construct a figure *similar* to this polygon, but of ¾ its area.

3. Construct a triangle equal to the same polygon, having its base in AB produced, and its vertex in the angle D.

4. Construct in the same manner a triangle equal to the polygon (2), and show that this triangle is ¾ of the former.

IV.

1. Two lines are in the proportion of 3 : 5; their *plans* are in the proportion of 1 : 2; at what angles are these lines inclined to the paper?

2. Two parallel lines AB, CD are 2 and 3 inches long, and are inclined to the paper at such an angle that their *plans*, *ab*, *cd*, are 1·3, 1·95 inches long; the points A and C are both 1·5 inches above the paper, and the line joining

them is ·75 inches long and perpendicular to both. Draw these lines in *plan* and *elevation.*

3. Three planes pass through a point P, 3·5 inches above the paper; the planes are inclined to the paper at 37°, 45°, 58°, aud their three *traces* (or the lines in which they cut the paper) form an equilateral triangle. Express these three planes and their common intersections.

V.

An oblique pyramid has for its base a square, ABCD, of 2 inches side; the face on AB is inclined at 50°, that of BC at 60°, that on CD at 70°; draw the plan of the solid, and write down the inclination of the fourth face on DA, and the height above the paper of the vertex or apex of the solid.

2. A right, or regular pyramid, 4 inches high, has a regular pentagon of 1·3 inches side for its base; the solid is cut by a plane parallel to one face, and passing through the middle point of the axis. Determine the true form of the section.

3. Draw the plan of the lower frustum of the pyramid as lying on the section in the paper.

4. Draw the plan of a cube of 2·5 inches edge when three of its corners are raised 1, 1·75, 2·75 inches above the paper.

VI.

1. A cone 3 inches high, with a base 2 inches in diameter, lies on its side on the paper, show the solid by a *plan* and *elevation.*

2. The same cone is cut by a plane passing through the middle of its axis, and parallel to the paper or horizontal, determine the line of the section.

3. Supposing the whole cone were *developed* (that is unrolled and spread flat), draw on this figure the line of the section of the last question, as lying on the surface.

4. A sphere of 2 inches diameter rests on the paper—it is touched by three planes all inclined to the paper, at 50°, and all equally inclined to each other—determine the height of the pyramid formed by these planes.

VII.

(Perspective Projection.)

(The eye of the spectator is six inches from the plane of the picture.)

1. A *square* of ·25 inches side is the projection of one on the other side of the picture, at what distance must it be from the spectator if the original square is 1·25 inches side?

2. Draw the projection of the same square when its plane is horizontal, and two inches below the spectator's eye.

(1.) When one side is parallel to the picture, and 1 inch from it:

(2.) When one side is inclined to the picture, at 35°, and one corner 1 inch from it.

3. Draw the projection of a cube of 1·25 inches edge in any position, at pleasure, provided *no edge nor face* is parallel to the plane of the picture.

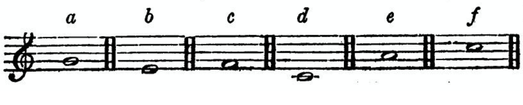
THEORY OF MUSIC.

THREE HOURS ALLOWED.

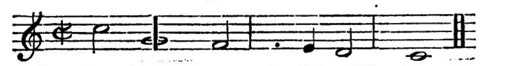
Rudiments of Musical Grammar.

(The answers to these questions must be given on music paper, and in the order in which they are put.)

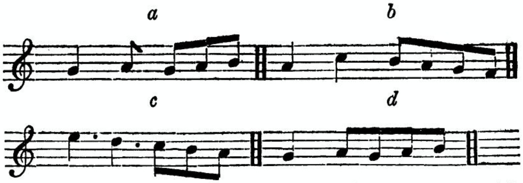
1. Place a minor third above *a* (of the following), an imperfect fifth above *b*, a perfect fourth above *c*, a minor seventh above *d*, a diatonic semitone above *e*, and a chromatic semitone below *f*.



2. Write the following in a more modern form.

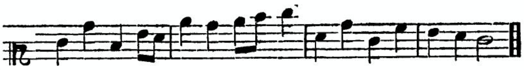


3. Put time signatures to each of the following.

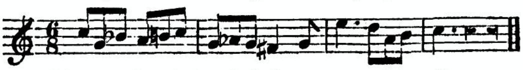


4. Write the scale of Re (D) minor, in every form with which you are acquainted.

5. Write the following, at the same pitch, on the treble stave.



6. Transpose the following into Mi♭ (E♭).



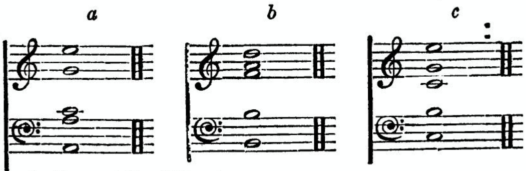
7. Place each of the clefs in every position it can occupy on the stave, and write over each the name of the voice for which it is so used.

8. Write, from memory, any melody with which you are acquainted.

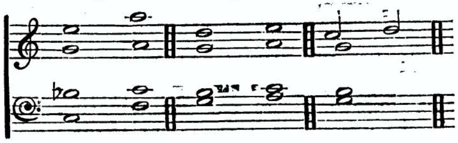
II. Harmony, Counterpoint, and Musical History.

(The answers to these questions (Nos. 5 and 6 excepted), must be given on music paper, and in the order in which they are put.)

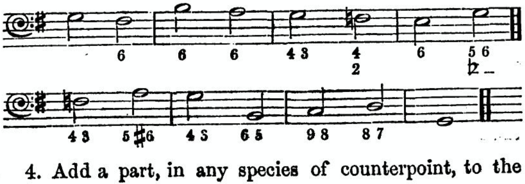
1. Convert *a*, *b*, and *c*, severally, into discords of the dominant seventh, and resolve each of them.



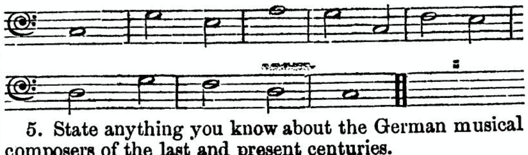
2. Correct the following.



3. Add three parts to the following.



4. Add a part, in any species of counterpoint, to the following.



5. State anything you know about the German musical composers of the last and present centuries.

6. Give the names of the principal English composers of the 16th and 17th centuries.

Proceedings of Institutions.

◆

Salford Working Men's College.—The report for last year says that continued development and successful progress have hitherto attended every department of the College. The average number of members during the past year has been 321 per term; the average increase over the three corresponding terms of the preceding year being 68 members. A great majority of the members of the College come strictly within the meaning of the term "working men," in its most restricted sense, and nearly all come within the term construed "liberally." This fact is the more especially important as it proves the fulfilment of the chief object and aim of the College. The return of the number of the members who joined the classes shows an average of 21 members for each subject taught, and an average attendance at each class of 13. The total number of members on the class-lists averaged 438 per term. Three examinations have been held during the year. The treasurer's abstract of the receipts and expenditure shows that the income of the College has amounted to £254 11s. 7d., and the expenditure to £193 5s. 10d., leaving a surplus of £63 5s. 9d. to the credit of the College on the revenue account, but on the building fund account there has been expended £78 19s. 10d., which leaves a balance against that account of £21 16s. 1d. The nett ballance, therefore, in hand on the two accounts is £41 9s. 8d. The adult female classes are progressing satisfactorily. The boys' day school has been attended by an average of 123 pupils per week, and the girls' day school by an average of 90 pupils per week; they have both been efficiently conducted, and are spoken of in favourable terms by the Government Inspector in his report. The music class, for girls, is also in a satisfactory state. The boys' evening classes continue as usual. Analysing the trades of the 367 members of the last term, 82 of them only come within the designation of clerks, the rest, 295 in number, being composed of mill-hands, porters, mechanics, and various trades and handicraftsmen. The 20 class-lists, excluding the gymnastic class, contain 467 names of students, and the average attendance at the classes during the last term was 302 per week. Dividing the classes into four groups—the first group, comprising reading, writing, arithmetic, and grammar, has had 199 students, whose average attendance has been 104 per week. The second group—including algebra, mensuration, geometry, mechanical drawing, chemistry, and free-hand drawing and painting, has had 62 students, whose average attendance has been 50 per week. The third group—including English history, logic, Latin, and geology, has had 57 students, and the average attendance has been 45 per week. The fourth group—comprising French, German, elocution, phonography, and book-keeping, has had 133 students, and the average attendance has been 99. Referring to the first group, and keeping in view that adult students only are therein referred to, it is clearly obvious that notwithstanding the great progress made during the past twenty years in the education of youth, the large increase in the number of public day and Sunday schools, their superior efficiency, the moderate terms, and, notwithstanding, also, the universal acknowledgment by the working classes of the value and importance of education, a large number of the youth of this district either do not acquire the first rudiments of education at all, or the education imparted to them is so insufficient and imperfect as to necessitate a recommencement when in more mature years they join this College. Referring to the classes comprised within the second group, it is obvious that studies of an exact and practical character are those which first attract and most engage the attention of the working man. He can grasp their scope and aim. He looks for tangible results. He requires to know things as they really exist, their forms, their qualities, their powers. Hence at this College we must expect to find the largest number of working men engaged in these studies. Many of them, no doubt, have in view the application of the practical sciences to their respective trades, and in this view the teachers may justly be proud of the result of their labours, inasmuch as they are enabling young men to raise their social standing and to increase their means. Indeed, to Institutions such as this, may undoubtedly be referred the revolution now taking place in most of the trades, by which skilled or scientific labour is rapidly being substituted for the more ordinary kinds. But a large number of the pupils devote themselves to these studies from the love of investigating that which is real and true, as a means of mental training, and as first steps towards a wider field of investigation and thought to which these sciences are the stepping-stones. In the third group are comprised the studies which it must be regretted do not attract so much the attention of the working man as their importance demands. Indeed, it is apparent that highly intellectual and refining studies cannot be expected to enlist the sympathies or obtain the devotion of more that a small proportion of the members of this College. With respect to the subjects included in group No. 4, they are provided in the College, to enable all who desire it to improve themselves in the way their own interests or special motives may dictate. It must be remembered that entire freedom of choice as to the nature of the studies to which they devote themselves, is allowed to the students, so that the class-lists of this College are an exact index of their requirements and tastes. A careful scrutiny of the names of the members on the class-lists, for two or more years, developes the fact that a very small proportion of the members enter the College to undergo a systematic course of instruction; indeed, it clearly indicates that generally each member enters it for a specific object of study, to supply some one or two wants, and that object accomplished, he is not again seen until some other requirement sends him back. The examinations which have taken place during the past year, under the auspices of the Society of Arts and the Council of Education, furnish the most satisfactory assurance as to the quality of the education given. The nature of this Institution, however, forbids us to expect that many of the pupils will avail themselves of the advantage these examinations are calculated to confer upon them. The very facts mentioned above indicate that however well up the student may be in the special subject of the examination, his entire devotion to that subject, to the exclusion of other necessary studies, will often occasion his rejection in the preliminary examination, and if he should be enabled to pass that examination, his want of proficiency and readiness in writing and English composition place him at a disadvantage in the final examination. With regard to the constitution of the College, it is of a character to ensure, by the widest possible system of representation, the existence of a popular executive in whom the entire management is vested. It has no restrictive rules. It allows the freest possible scope for development. It ensures its adaptation to the wants of the members. It is imperative only in this:—that the object of the College must be to enable working men to improve their education and to acquire knowledge. These terms, honestly construed, are sufficient to ensure and protect the College from being turned away from its legitimate path. To be of use to the working population, its fees must always be of the most moderate character, hence its existence as a Working Men's College will depend very much upon the generous sympathy of honorary teachers. But this sympathy can only exist with a state of internal harmony. The moment discordant elements are introduced into the College, that moment it will begin to decline. Internal peace means success, and the continuance of the privileges the College affords. Discord means the rapid decay and ruin of the Institution. Let this be well understood by the members; let every new proposition be carefully considered and critically examined before its subject be introduced into the College; let every department carefully abstain from those highly exciting and seductive popular subjects, the introduction of which has, from time to time, ruined many Institutions, and the career of this College will be a continued success. The following is a return of the trades of the members:—Mercantile clerks, 72; warehousemen, packers, &c., 62; printers, 19; decorative artists, 3; shopmen, 12; curriers, 2; shoemakers, 4; architects, 2; chemists, 3; various handicraftsmen, 46; teachers, 5; draughtsmen, labourers, millhands, and sundry miscellaneous occupations, 126. Total, 361. The ages of the members are as follows:—16 and under 20, 147; 20 and under 30, 185; 30 and under 40, 23; 40 and under 50, 6. Total, 361. The return of the number of classes attended by the several members shows that 187 attend one class each; 109 attend two classes each; 18 attend three classes each; 7 attend four classes each; 2 attend five classes each; 1 attends six classes.

PATENT LAW AMENDMENT ACT.

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APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, September 5th*, 1862.]

Dated 31*st May*, 1862.

1647. I. Villa, 12, Denmark-street, Soho—A new and improved method of exhibiting terrestrial and astronomical phenomena, and of facilitating the solution of problems relating thereto, without the aid of calculation.

Dated 21*st July*, 1862.

2075. W. Clark, 53, Chancery-lane—An improved pomade or balsam. (A com.)

Dated 7*th August*, 1862.

2215. R. A. Brooman, 166, Fleet-street—Imp. in covering ships and vessels built of wood, or iron ships, with a backing of wood, before placing iron, steel, or other armour plates on such ships and vessels. (A com.)

Dated 9*th August*, 1862.

2236. G. T. Bousfield, Loughborough park, Brixton—Imp. in apparatus to be used in the manufacture of hat bodies. (A com.)

Dated 14*th August*, 1862.

2280. A. Walker, Liverpool—A new instrument to determine or ascertain the depth of water and the distance a ship has run.

Dated 16*th August*, 1862.

2306. R. Barclay, Paris, Canada West—Imp. in chronometers and other time-keepers.

2308. C. H. J. W. M. Liebmann, Huddersfield—Imp. in machinery for finishing textile fabrics.

2310. Colonel M. Iturriaga, Tavistock-street, Bedford-square—Imp. in fire-arms.

Dated 18*th August*, 1862.

2312. G. Chapman, Edinburgh—Imp. in reaping machines.

2314. J. Cimeg, Great James-street, Bedford-row—Imp. in depositing silver and other metals on fabrics and other materials.

2316. W. E. Newton, 66, Chancery-lane—Imp. in connecting plates, sheets, or slabs of metal or other materials, and fastening the same on to framing applicable to armour plating for ships, vessels, or batteries, and to roofing and other similar purposes. (A com.)

Dated 19*th August*, 1862.

2320. T. Wilkinson, Rathmines, Dublin—Imp. in machinery or apparatus for singeing pigs.

5322. General H. Dembinski, 13, Rue de l'Oratoire, Paris—A motive apparatus and processes proper for giving to it a continuous motion and unlimited strength.

2324. W. J. Hoyle and J. Proven, Halifax—Imp. in mechanism and arrangements for supplying lubricating matter to the cylinders of steam engines, and to the bearings and other surfaces of mechanism.

Dated 20*th August*, 1862.

2326. J. G. Tongue, 34, Southampton-buildings, Chancery-lane—Imp. in processes and apparatus for extracting the natural wax or fatty matters from wool, hair, or other animal or vegetable substances containing the same, and in the application thereof to various useful purposes. (A com.)

2328. C. Callebaut, 4, South-street, Finsbury—Imp. in sewing machines.

2330. W. H. Hutchinson, Newton Heath, near Manchester—Imp. in the manufacture of ammonia and the prussiates of potash or soda, and in apparatus employed in such manufacture.

2331. J. Standish and J. Gooden, Egerton, near Bolton—Imp. in machinery or apparatus used in the preparation of cotton, wool, flax, and other fibrous materials to be spun.

2332. S. Wilkes, Wimpole-street—An improved attachment for door knobs.

2333. C. Chinnock, Queen's-road-west, Regent's-park—An improved construction of cork screw.

Dated 21*st August*, 1862.

2334. S. J. Paris, Manchester, and W. Bate, Salford—Imp. in alphabetical electric telegraphs.

2335. J. C. Schemmann, Hamburg—Imp. in the manufacture of steel.

2337. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in governors for steam engines. (A com.)

2338. T. Clements, P. Llewellin, J. Llewellin, and J. W. James, Bristol—Imp. in the construction of a self-acting lubricator for lubricating various parts of steam-engines.

2340. A. Boubee, Paris—An improved veil protector.

Dated 22*nd August*, 1862.

2341. S. F. Griffin, New Adelphi-chambers—Imp. in apparatus to be used in the distillation of petroleum or any oleaginous, resinous, or alcoholic bodies.

2344. W. Barrett, Norton Furnaces, near Stockton-on-Tees—Imp. in casting railway sleepers and chairs where tie-bars are used.

2346. J. Mackay, Glasgow—Imp. in the manufacture of soap powder.

2347. R. Harrington, Northampton-street, Birmingham—Imp. in umbrellas and parasols, and in the manufacture of parts thereof.

2349. D. Moore, Brooklyn, New York—Imp. in breech-loading fire-arms.

2350. G. Bottomley, Leeds — Improved apparatus for expressing moisture from pulpy or solid substances.

2351. D. Moore, Brooklyn, New York—Imp. in revolving fire-arms.

2352. W. Carwood, Stepney, W. Boaz, Bromley, and C. Colwell, Belvedere-place, Southwark—Imp. in apparatus for propelling ships and other vessels.

2353. T. Wood, Manchester—Imp. in the slide valves of steam-engines.

Dated 23*rd August*, 1862.

2357. M. K. Angelo, Gloucester-place, Portman-square—Imp. in apparatus used in the manufacture of shellac.

2358. M. Henry, 84, Fleet-street—Imp. in stuffing boxes and their packings. (A com.)

2359. C. H. Roeckner, Marsh-street, Bristol—Imp. in syphons for discharging or drawing off large bodies of water, and in the mode of charging, fixing, and constructing the same, whereby they are rendered permanently self-acting.

2360. W. E. Newton, 66, Chancery-lane—Imp. in the mode of and apparatus for treating fermentable substances for brewing and distilling. (A com.)

Dated 26*th August*, 1862.

2368. J. Rider, Basinghall-street, Leeds—Imp. in the construction of fencing posts or standards, to be used either for straining or otherwise sustaining fences, the said improvements being also applicable to all kinds of gate posts, telegraph poles, signal posts, or other upright standards or pillars.

INVENTION WITH COMPLETE SPECIFICATION FILED.

2386. M. A. F. Mennons, 24, Rue du Mont Thabor, Paris—Imp. in smoke-consuming furnaces. (A com.)—28th August, 1862.

2387. M. A. F. Mennons, 24, Rue du Mont Thabor, Paris—An improved assorting apparatus applicable to the numbering of raw silks. (A com.)—28th August, 1862.

PATENTS SEALED.

[*From Gazette, September 5th*, 1862.]

September 5*th.*

604. J. Barker.
607. J. G. Shipley.
612. J. Fowler, jun., D. Greig, and R. Noddings.
613. T. Ball, W. Ball, and J. Wilkins.
616. R. Restell.
617. T. H. Wood.
619. A. W. Williamson.
621. G. Edmonson.
622. A. Blair.
623. W. Paterson, W. A. Sanderson, and R. Sanderson, jun.
626. J. Deane, jun.
628. P. J. Guyet.
631. W. Palmer.
640. R. A. Brooman.
641. W. Parker and G. H. Batman.
642. W. Spence.
646. A. Barclay.
648. J. T. Calow.
652. J. Nadal.
656. O. and J. Kerautret.
657. E. G. Camp.
658. C. Hall.
659. T. B. Wilson & W. Wilson.
662. G. Davies.
670. J. Johnson and S. Morris.
671. W. Conyers.
674. A. M. A'Beckett.
701. A. Quinard.
710. W. Turner.
717. W. McAdam.
718. J. Hunter and R. Scott.
721. S. N. De la Haye de Barbezieres.
731. L. P. Mongruel.
746. M. A. F. Mennons.
771. J. Cumming.
797. E. Lord.
807. M. Henry.
815. E. Morewood and A. Whytock.
825. F. Morewood and A. Whytock.
836. R. Boby.
842. A. V. Newton.
913. H. Smith.
1108. W. E. Newton.
1162. C. Callebaut.
1261. W. E. Newton.
1282. A. H. Fielden.
1419. J. B. Pope.
1812. J. B. Wood
1845. G. Haseltine.
1884. E. Hunt and H. D. Pochin.
2030. A. V. Newton.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, September 5th*, 1862.]

1966. B. Baugh.